

We differentiated with colors our responses for the reviewers comments and questions. While the reviewers comments and questions are indicated in black, our responses are written in green. Response for particular comment immediately below the comment.

**RC2:** ['Comment on tc-2023-117'](#), Anonymous Referee #2, 05 Nov 2023

This manuscript provides new information on Late Pleistocene ice margin fluctuations at the southern fringe of the Fennoscandian Ice Sheet. The new evidence comprises 11 OSL measurements from fluvio-glacial and periglacial deposits exposed in the Rożental gravel pit, and 5  $^{10}\text{Be}$  boulder surface exposure ages, all derived from a 30km<sup>2</sup> area of the moraine plateau in northern Poland. Unfortunately, the  $^{10}\text{Be}$  ages do not contribute to the discussion, however it is important that they were presented here for sake of transparency.

Yes of course, OSL data are the most important in our reconstruction, but we do not agree that the Be-10 ages do not contribute to the discussion. Even from this scattered dataset we could note the main mode of Be-10 ages ( $18.0 \pm 4.3$  ka) and indicate a possible signal of the ice sheet retreat after ~18 ka, what corresponds to the deglaciation after deposition of till Rz2b and contributed to the overall discussion (lines 317-323).

The millennial scale fluctuations are based on the Bayesian modelling of the OSL data from Rożental gravel pit, where 3 glacial tills separate periglacial sedimentary features. The authors link their millennial scale fluctuations to evidence of meltwater sediment deposition in the Bay of Biscay. This apparent relationship is speculative but interesting. Overall, the manuscript presents new terrestrial data on ice margin fluctuations in northern Poland and is well within the scope of TC. The paper reaches substantial conclusions which are backed up by the evidence presented. The methodology is well described and all relevant data necessary for readers to recalculate the ages is provided. References are appropriate, but some additional ones are suggested for Figure 1. The supplementary materials are generally good, boulder sizes are missing in Table A4.

Thank you for your opinion. Yes, we agree that some of our interpretations/discussion are speculative, but we tried to speculate based on the results we obtained. Our opinion regarding this was also stated in the responses for the Referee #1, in particular for the comments regarding lines 276-277 and 385.

Below I have attempted to correct the grammar and also make more detailed comments. LXX refers to Line XX in the submitted manuscript.

Thank you very much for all grammar/vocabulary/style corrections, we will correct the manuscript according to the all below suggestions.

Suggested edits:

L15: Optically stimulated luminescence (OSL) was used to date...

L17: <sup>10</sup>Be surface exposure dating was used...

L18: ...resting on the surface...

L23: "confront" is not the right word, compare is better

L35: The sentence "The last two ice sheets....Rignot et al., 2019)." can be removed. It does not add anything meaningful.

L40: geological records

L41: enables correlating

L43: glacial records...nature of the glacial

L48: see comment for L15, or use OSL

L49: see comment for Line17

L52: see comment for L23

L59: ...within an elevated...

L62: denivelations should be relief

L64: sheet's should be sheet

L65: The sediment outcrop where...

L78: ...of a well-preserved...delete "a"

L86: ...and it consists of...should be ...and consist of...

L109: ...most of surface... should be ...most surface...

L110: massive is subjective, give dimensions

L110-111: Suggest changing ", which commonly occur at the surface of moraine plateau,..." to "located on the moraine plateau,..."

L114: deluvium, or diluvium, is an obsolete term. Is this alluvium?

Yes, it is a wrong word in English. We mean loose or poorly cohesive sediment formed as a result of the accumulation of fine mineral particles from soils, clays, till, weathered coverings, etc., washed and eroded from slopes by rainfall and/or mass movements. To describe this kind of sediments we will change the description to "alluvium and colluvium".

L120: The sequence...

L122: "reveals" should be "show"

L125: "with a fossil" should be "with fossil"

L142: PCV should be PVC

L147: "remaining of other" should be "remaining other"

L157: "decay chain and potassium" should be "decay chains of potassium"

L158: delete "the reference materials, namely"

L164: "consists of sequence of sediments units" should be "consists of the sequence of sediment units"

L166: "sediments deposition" should be "sediment deposition"

L166: *likelihood* should be *likelihood* make sure you check every occurrence.

L172: "sediments deposition" should be "sediment deposition"

L175: "pre-date particular event" should be "pre-date a particular event"

L184: "with *IntCal20*" should be "with the *IntCal20*"

L187: see comment for L110

L190: "lithologies as" should be "lithologies such as"

L194: "decontaminated" should be "separated"

L232: "samples MAM" should be "samples the MAM"

L133: "as Rz1" should be "as the Rz1"

L234: "It is visible especially within aliquots distribution of..." should be "This is especially visible in the aliquot distributions of..."

L236: "deposition of Rz1 unit" should be "deposition of the Rz1 unit"

L241: "dominates" should be "dominate"

L242: "revealing" should be "shows a", "with CAM" should be "with the CAM"

L248: "with CAM" should be "with the CAM"

L286: What do you mean by boulder exposition after deglaciation and/or significant postglacial erosion... How much erosion would you need to explain the young age? Why would this boulder erode so much faster than the others you sampled? Please provide a reasoned argument for your explanations of the young age. The most likely reason for the young age is that the boulder has moved or that it was buried and subsequently exposed. Could this be the case?

Yes, agree. Probably some boulders were buried and subsequently exposed. Relatively high relief of the study area promotes post-glacial erosional processes, i.e. rainfall washing and/or mass movements along slopes, degradation of the original moraines surface and possible exhumation of erratics from eroded deposits. We will correct the explanation of the young age accordingly in the revised version of the manuscript.

L320: "of boulder" should be "of a boulder"

L341: "for Rz1" should be "for the Rz1"

L342: "of Rz2a" should be "of the Rz2a"

L349: "formation" should be "formations"

L350: "in north-" should be "in the north-"

L351: "be also related to regional" should be "also be related to a regional"

L354: "a large" delete "a"

L361: "~17 ka and" delete "and"

L366: "record" should be "records"

L368: "been already" should be "already been"

L376: "sediments" should be "sediment"

L377: "sediments" should be "sediment"

L403: "record" should be "records"

Figure 1 caption: provide references for the LGM and PM ice margins. The outline script for the LUB samples and Rožental reduces clarity. Either use solid white or increase the size of the labels. The Gd coring site label in the legend does not match the style on the map. Label the grey dashed box as Figure 2.

OK, we will correct the figure according to your suggestion.

Figure 2 caption: What is the grey dashed box? What is deluvium? If you mean diluvium, it is an obsolete term. Is this material fluvial or glacial? Please check appropriate terminology.

The grey dashed box is the area of the figure 5b. We should make the label more visible. Regarding "deluvium" – we explained above.

Figure 5 caption: "(a) Sediments profile" should be "(a) Sediment profile"

Figure 6: Drawing ice limits on maps is one of the hardest processes to justify to the community. The process probably generated quite a lot of discussion and various versions of the maps. What are the uncertainties of the isochrons on the map, and how were the locations of these limits established. The explanation in the text suggests ambiguity "not equivocal" about the exact position. Could this ambiguity be shown on the map with a maximum/minimum limit?

Yes, thanks for this remark. The question of the ice-margin positions showed in Fig. 6 was also asked by Referee #1. We explained as far as we could the basis for interpreting ice-margin positions on panels C and E in Fig. 6 and gave some closer looks on digital elevation model with particular landforms suggesting ice-margin positions in our response for Referee #1. We will mark the ice margin positions as "possible" positions inferred from landforms and sediments spatial distribution in the study area, and with dashed lines rather than solid in the revised version of the manuscript. We hope this will show the ambiguity "not equivocal" in this case.